Parlindungan and Prasetyo, Int J Ophthalmic Pathol 2020, 9:4
DOI: 10.37532/iopj.2020.9(4).246

International Journal of Ophthalmic Pathology

Case Report

A SCITECHNOL JOURNAL

Simple Limbal Epithelial Transplantation (SLET) Following Chemical Injury: A Case Report

Ucok Parlindungan* and Kukuh Prasetyo

Abstract

Purpose: This is a case reporting our experience in performing Simple Limbal Epithelial Transplantation (SLET) on patient with unilateral Limbal Stem Cell Deficiency (LSCD).

Case Report: A 56-year-old male came to Jakarta Eye Hospital with blurry vision on one of his eye following base chemical injury on the eye 1 month prior to his initial visit. He had already received conservative medication in order to reduce inflammation. We performed SLET by placing amniotic membrane graft on the corneal surface and fixating it using fibrin glue, followed by placing ten pieces of limbal tissue cultivated from his fellow eye in a circular manner. In order to reduce discomfort sensation that might appear, bandage contact lens was placed on the corneal surface. Corneal edema decreased gradually in one month post-operatively.

Conclusion: SLET might be considered as one of Ocular Surface Reconstruction techniques that widely used on unilateral severe chemical corneal injury.

Keywords:

Chemical corneal injury; Simple limbal epithelial transplant; Limbal stem cell deficiency.

Introduction

Ocular chemical injuries are a true ocular emergency and require immediate and intensive evaluation and treatment. The sequelae of an ocular burn can be severe and particularly challenging to manage. Ocular chemical injuries can occur under diverse circumstances and common in industrial chemical laboratories, in machine factories, in agriculture, and among labourers and construction workers. Chemical burns of the eyes occur most often among the age group from 20 to 40 years, with young men at greatest risk. Recent studies put the incidence of ocular burns of the eye at 7.7-18% of all ocular traumas. Industrial accidents caused 61% of these burns; 37% occurred in the home [1]. Automotive battery acid burns have become increasingly more common. During recharging of a lead acid storage battery, which contains up to 25% sulfuric acid, hydrogen and oxygen produced by electrolysis form a highly explosive gaseous mixture [2,3].

The injuries caused by chemical burns to the eye can range from mild unilateral conjunctival or corneal epithelial damage to sight-threatening damage to the conjunctiva and cornea. The resulting visual impairment and blindness has important health, socio- economic and quality-of-life implications, which can lead to lost economic gain, and missed employment and educational opportunities, resulting in reduced quality of life generally. The symptoms of chemical ocular burns include photophobia, tearing and pain, while conjunctival hyperemia, subconjunctival haemorrhage and chemosis are some of the presenting ocular signs of the condition [4].

The primary intention of early surgery in the face of a chemical ocular burn is to maintain the globe and promote reepithelization. Surgical management starts with initial debridement of the necrotic tissue and continues with any procedure to improve reepithelization that is aimed to restore corneal clarity, like amniotic membrane transplant, tenoplasty, limbal stem cell transplant, corneal transplantation, and keratoprothesis [5].

In the last three decades, both the understanding of limbal biology and the techniques of limbal transplantation have evolved considerably. Although conjunctival- limbal or kerato-limbal grafting continues to be practiced, transplantation of ex vivo-cultivated limbal epithelial sheets has become popular in many centers worldwide. Simple limbal epithelial transplantation essentially showed that direct transplantation of a minuscule limbal fragment could reverse LSCD without the need of ex vivo expansion. It is obviously a development of former technique called CLET (Cultivated Limbal Epithelial Transplant) that reported to have long term outcomes compared to other transplant [6]. Former study showed that the successful rate of SLET was comparable to CLET with a better result on children (71% SLET vs 37% CLET) [7] .This paper is aimed to report a case of our experience in performing SLET on chemical corneal injury.

Case Report

A 56-year-old male came to our hospital with a complaint of blurry vision. He had a history of base chemical injury at his working place one month prior. He underwent profuse irrigation and was given topical steroid. He wished to be able to see clearly (Figure 1).

Examination showed that there were a significant corneal haze and large epithelial defect almost on the entire corneal surface with visual acuity of only hand movement. B-scan ultrasound examination showed that inner part of the eye was within normal limit. We decided to perform surgery for the patient after the inflammation subsided during a month of observation.

Patient was being given local anaesthetic using retro bulbar injection of lidocaine 2%, the entire operating field was cleaned with antiseptic and covered with sterile drape. Eyelids were opened using speculum.

First, we did a 360 degrees peritomy and conjunctival resection to make sure that there will be no further corneal conjunctivalization. Bleeding was controlled with dry low pulse cauterization. In order to improve epithelialization, we put amniotic membrane which was fixated using fibrin glue on the corneal surface.

Limbal cultivated tissue from contralateral eye was being prepared before the next step by cutting into 10 small cuts. The cultivated cuts

***Corresponding author:** Dr. Ucok Parlindungan, Jakarta Eye Center, Health Consultation and Eye Surgery, Teuku Cik Ditiro No. 46, Menteng, Jakarta pusat, Indonesia 10310 E-mail: ucok_pasaribu@jec.co.id

Received: June 05, 2020 **Accepted:** September 10, 2020 **Published:** September 17, 2020

doi: 10.37532/iopj.2020.9(4).246

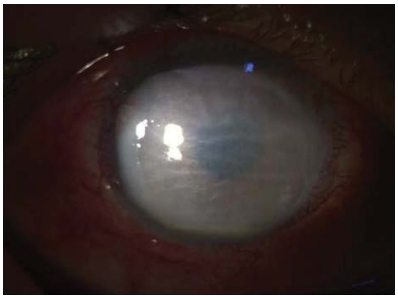

Figure 1: Preoperative photo.

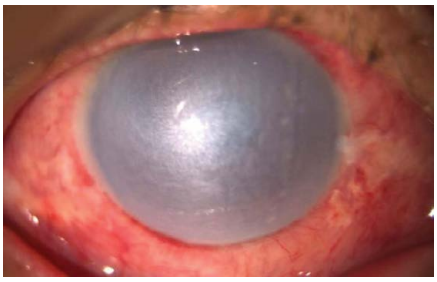

Figure 2: One month post operative.

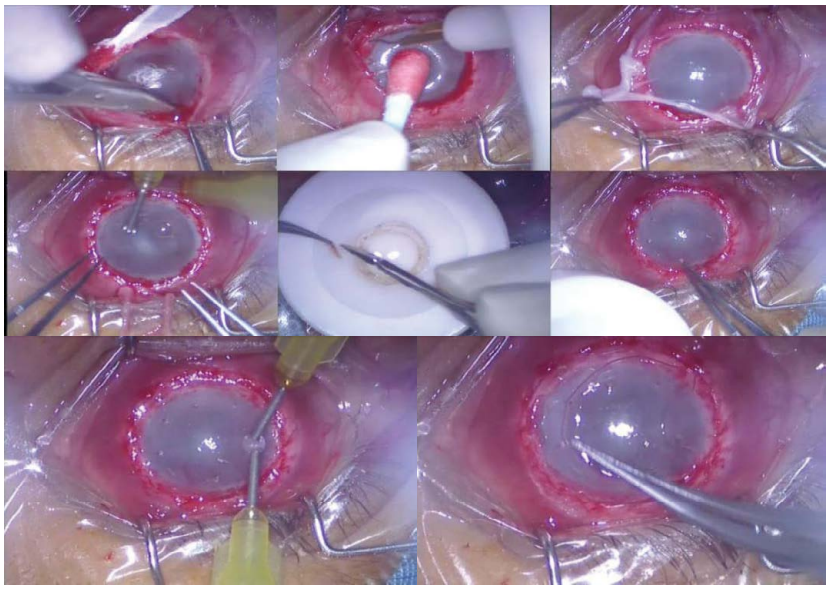

Figure 3: Simple Limbal Epithelial Transplant (SLET) technique.

were then placed in a circle manner and fixated once again using fibrin glue.

In order to fixate both amnion membrane graft and cultivated limbal cell and reduce discomfort, bandage contact lens was put on the corneal surface. The procedure can be seen on (Figure 2). Standard post-operative treatment with topical corticosteroids and antibiotics were administered after the surgery.

At one-month post-operative follow up, the cornea became gradually better and clearer with visual acuity 6 meters fingers counting and the epithelial defect was resolved (Figure 3). Patient was suggested to undergo penetrating keratoplasty for visual rehabilitation. Unfortunately, it could not be done due patient's financial difficulty.

Discussion

Corneal epithelium that covers corneal surface and plays a major role in protection and transparency. Epithelial cells shed regularly and replaced by stem cell sources located at the limbus. Damage to the stem cells or disruption of the niches may lead to Limbal Stem Cell Deficiency (LSCD). In the absence of the corneal epithelium, the conjunctiva proliferates over the cornea resulting in opacification and vascularization, which in turn may lead to reduced vision, pain, and photophobia. LSCD is also associated with poor epithelial adhesion, resulting in recurrent erosions and persistent corneal epithelial defects. This is a typical clinical feature of LSCD which we also found in our patient. At chronic stage, the ocular surface is scarred and extensively neovascularized [8,9].

Clinical treatment of LSCD varies according the degree of severity and extent of involvement. For those with mild to moderate LSCD, treatment option is aimed to control symptoms and causes. For severe LSCD, it is necessary to perform ocular surface reconstruction (OSR). OSR is a series of procedures to reconstitute the ocular surface into its original anatomical and physiological condition, which includes amniotic membrane transplantation (AMT), conjunctival limbal grafting, and other limbal stem cell transplantations [9,10].

Simple limbal epithelial transplantation (SLET) is a technique developed by Sangwan VS [6,7] in 2010. A 2x2 mm strip of donor Limbal tissue obtained from the fellow healthy eye was divided into eight to ten small pieces and distributed evenly over an amniotic membrane placed on the cornea.

In this case, after SLET procedure, the patient had complete healing of persistent epithelial defect and improvement of visual acuity,

which was considered a great and promising result. The mechanism of action of SLET is through multidirectional growth of epithelial cells from each transplant until all epithelial islands merged and created a confluent sheet of epithelium on the corneal surface [11]. It is important to note that amniotic membrane plays a critical role in promoting and preserving the stemness of the limbal epithelial stem cells as they stratified over the membrane [12]. Basu et al reported that corneal surface after SLET was identical to that of the native cornea, comprising uniform non keratinized stratified squamous epithelium without goblet cells or vascularization, thus providing not only surface restoration but also significant improvement in visual acuity [7].

However, since SLET is an epithelial regenerative procedure, it has limited impact on corneal stromal opacification. Thus, cases with severe stromal opacification, as what was observed in our patient, will require corneal transplantation in the future in the form of either anterior lamellar or penetrating keratoplasty (PK) [13].Unfortunately, this procedure could not be performed due to patient's financial issue.

Besides SLET, several different surgical techniques of limbal stem cell transplantation have emerged with time. The conventional approach which was first described by Kenyon and Tseng in 1989 for autologous transplants has been known as conjunctival-limbal autografting (CLAU). In this technique, two large conjunctival-limbal lenticules are harvested from the healthy eye and directly transplanted to the affected eye. Unfortunately, CLAU is known to be associated with complications including the risk of developing iatrogenic LSCD in the donor eye [13]. Yet, CLAU known to be expense saving for the fact that it does not need amniotic membrane as its advantage [10,14].

Pellegrini et al [15] on 2017 proposed a technique called CLET by using a cultivated limbal tissue from fellow eye in 2x2 mm size. Although CLET minimized the problems of CLAU, cell expansion necessitated a clinical- grade laboratory with regulatory approvals which was and still is extremely expensive to build and maintain [13].

In total bilateral LSCD, limbal stem cell transplantation from allogenic tissue is necessary. It might be obtained from cadaveric or living related donor and transplanted directly to the ocular surface [16]. Allografts require prolonged use of systemic immunosuppression and the long term survival of allograft is worse than that of autologous transplantation [17]. Transplantation of cultivated autologous oral mucosal epithelial cells has achieved good success in stabilizing the ocular surface [18].

Former study showed that overall success of SLET was 70% at median follow up of 1.1 years [19]. While Basu et al [7], which remains to be the largest study evaluating the successful SLET, had a success rate up to 76% with mean follow up 35.5 months.

Conclusion

Simple limbal epithelial transplantation can be considered and performed in severe unilateral chemical corneal injury.

Financial Disclosure

Authors do not have any financial interest.

References

1. Kuckelkorn R, Makropoulos W, Kottek A, Reim M (1993) Retrospective study of severe alkali burns of the eyes. Klin Monbl Augenheilkd 203:397–402.
2. Holekamp TL (1977) Ocular injuries from automobile batteries. Trans Sect Ophthalmol Am Acad Ophthalmol Otolaryngol 83:805–810.
3. Singh P, Tyaji M, Kumar Y, Gupta KK, Sharma PD (2013) Ocular Chemicals Injury and their managements. Oman J Ophthalmol may 6:83-86
4. Mashige K (2015) Chemical and thermal ocular burn: a review of cause, clinical feature, and management protocol. Journal of South African Family Pract Sep 58:1-4
5. Eslani M, Baradaran-Rafii A, Movahedan A, Djalilian AR (2014) The ocular surface chemical burns. J Ophthalmol 2014:196827.
6. Sangwan VS, Basu S, Macneil S, Balasubramanian D (2012) Simple limbal epithelial transplantation (SLET): a novel surgical technique for the treatment of unilateral limbal stem cell deficiency. Br J Ophthalmol 96: 931-934
7. Basu S, Surreka SP, Shanbag SS, Kethiri AR, Singh V et al. (2016) Simple Limbal Epithelial Transplant: long term clinical outcomes in 125 cases of unilateral chronic ocular surface burns. Ophthalmology 123: 1000 - 1010
8. Haagdores M, Van Acker SI, Van Gerwen V, Dubhghaill SN, Koppen C, et al. (2016) Limbal Stem Cell Deficiency; Current Treatment Options and Emerging Therapies. Stem Cells Int 2016:9798374.
9. Dong Y, Peng H, Lavker RM (2018) Emerging therapeutic Strategies for limbal Stem Cell Deficiency. J Ophthalmol 2018:7894647
10. Buenaga RF, Aiello F, Zaher SS, Grixti A, Ahmad S (2018) Twenty years of Limbal Epithelial Therapy: an Update on Managing Limbal Stem Cell Deficiency. BMJ Ophthalmol 3: e000164
11. Mittal V, Jain R, Mittal R (2015) Ocular Surface Epithelialization Pattern After Simple Limbal Epithelial Transplantation: An In Vivo Observational Study. Cornea 34:1227- 1232.
12. Mariappan I, Kacham S, Purushotham J, Maddileti S, Siamwala J, et al. (2014) Spatial distribution of niche and stem cells in ex vivo human limbal cultures. Stem Cells Transl Med 3: 1331- 1341.
13. Shanbag SS, Paitali CN, Giyil R, Dhontineni PL, Donthineni PR, et al. (2019) Simple Limbal Epithelial Tranplantation (SLET): Review of Indications, Surgical Techniques, Mechanisms, outcomes, Limitations, and Impact. Indian J Ophthalmol 67:1265-1277
14. Jackson CJ, Erno ITM, Ringstad H, Tonseth KA, Dart DA, et al. (2020) Simple limbal epithelial transplantation: Current status and future perspectives. Stem Cells Transl Med 9:316-327.
15. Pellegrini G, Traverso CE, Franzi AT, Zingirian M, Cancedda R, et al. (1977) Long-term restoration of damaged corneal surfaces with autologous cultivated corneal epithelium. Lancet 349:990–993
16. Biber JM, Skeens HM, Holland EJ, Kristiana DN (2011) The Cincinnati Proeedure: Technique and outcome of combined living-related conjungtival-limbal allografts and keratolimbal allografts in severe ocular surface failure. Cornea 30:765-771
17. Sejpal K, Bakhtiari P, Deng SX (2013) Presentation Diagnosis, and Management of Limbal Stem Cell Defficiency. Middle East Afr J Ophthalmol 20: 5-10
18. Nakamura T, Kinoshita S (2003) Ocular Surface Reconstruction using Cultivated Mucosal Epithelial Stem Cell. Cornea 22: S75-80
19. Gupta N, Joshi J, Farooqui JH, Mathur U (2018) Results of Simple Limbal Epithelial Transplantation in Unilateral Ocular Surface Burn. Indian J Ophthalmol 66: 45-52

Author Affiliation

Top

Department of Ophthalmology, Jakarta Eye Center, Health Consultation and Eye Surgery, Indonesia